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THE ASNA FORMULA: A NEW CONCEPT COST PER PASSENGER MILE (KILOMETER)

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March 1978

MIT

DEPARTMENT OF AERONAUTICS & ASTRONAUTICS

FLIGHT TRANSPORTATION LABORATORY
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THE ASNA FORMULA

A NEW CONCEPT

COST PER PASSENGER MILE (KILOMETER)

by

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of Middle East Airlines

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Preface

In May 1977, we were honored to have Mr. Asad Nasr, Chairman and President of Middle East Airlines give a Flight Transportation Seminar at MIT on the ASNA formula. In view of the interest generated, and a need for wider discrimination amongst aviation planners and managers, it was mutually decided that a report authored by Mr. Nasr would be published by the Flight Transportation Laboratory. We are happy to collaborate in this joint venture, since it should lead to better analysis.of various problems in airline planning.

Robert W. Simpson
Director, FTL

Biography

Mr. Asad Yusuf Nasr
Chairman and President, Middle East Airlines (MEA)
Beirut, Lebanon

Mr. Nasr was a graduate of Cambridge University in Mathematics and Law in 1950, and received his MA in 1955. He has taught Mathematics and Statistics at the American University of Beirut before joining MEA in 1955 as General Planning and Economics Manager. He developed the ASNA Formula for Aircraft and Schedule Evaluation in 1970 and has been the author of several articles on Air Transport and Management Systems. He received the 1st Annual Airline Technical Management Award from Air Transport World in 1975. He has received various honors including Commander of National Order of Tchad, Officer of the National Order of Lebanon, Order of the Republic of Egypt, the Laborer Medal of Lebanon, and the Order of the Legion of Honour from France.

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THE ASNA FORMULA

AN ECONOMIC OVERVIEW

Demand and Revenue

The demand for air transport is affected by the usual extraneous factors, demographic, social and economic, as well as those falling properly within the sphere of the industry itself such as the quality of service, safety, reliability, punctuality, speed, frequency, comfort, price.

But whatever the overall volume of the demand thus determined, it will not be evenly distributed. There will always be fluctuations in the demand for the individual flights.

This emphasis on the individual flight is simply a reflection of the nature of scheduled air transport and of the indivisibility of the air transport vehicle. Obviously, the use of averages would reduce the magnitude of demand fluctuations and would therefore make any analysis correspondingly less meaningful.

The fluctuations in individual flight demand have wide ranging effects on several aspects of the Air Transport Industry such as scheduling, optimum size of aircraft, frequency and capacity, price elasticity and the determination of fares, etc.

It will thus be observed that airlines tend to offer a level of capacity falling between the extreme values of demand, high and low. They almost never choose to operate an aircraft with a capacity sufficient to satisfy the demand for each and every flight. Equally, they are most unlikely to operate, continuously, on the basis of a virtually full aircraft.

In the first case, i.e. if the airline were to operate an aircraft sufficiently large as to cater for the highest demand levels, then it would be offering excessive capacity on most remaining flights. This would mean lower average load factors and lower profitability. Such consequences are not only harmful to the airline itself but, also, to the public, as lower load factors and lower profitability will necessarily mean that fares will be maintained at a higher level than would have been possible otherwise.

In the second case, i.e. where the airline is aiming at a continuous operation with a very high load factor, (say above 90%), there will be very few flights in respect of which the demand is totally satisfied by the capacity offered. On all the remaining flights, and they are the vast majority, there will be more passengers than seats, which means that certain numbers of passengers will be turned away, i.e. there will be frequent flights with overflows, some of substantial proportions. These will cause public dissatisfaction and outcry of such intensity as to harm the development of the industry and, probably, bring about the intervention of regulatory authorities.

Furthermore, the airline would not be maximizing its profits, since, at such load factors, as will be shown later, total profits can be increased by operating an aircraft with a greater seating capacity.

Airline managements are therefore required to determine that level of capacity which, given the specific volume and fluctuations of demand on a particular route or segment, produces the optimum compromise between the above constraints.

Another consequence of the fluctuations in the demand for individual flights relates to price elasticity and the determination of fares. On the basis that the demand for air transport is price elastic, the increase in demand, resulting from a given reduction in price, cannot be fully satisfied by the airline because of the fluctuations in individual flight demand. Also, the airline itself cannot achieve the full increase in revenue indicated by the price elasticity.

Cost

There is a <u>positive correlation</u> between aircraft size and aircraft/mile* costs, and a <u>negative correlation</u> between aircraft size and seat/mile* costs.

Airlines are constantly attempting to strike the right balance between the advantages of the lower seat/mile* costs of the larger aircraft against the advantages of the lower aircraft/mile* costs of the smaller aircraft. On the one hand,

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* or kilometer

escalation in costs, public clamour for lower fares, conservation of energy, protection of the environment, etc, are constant pressures on the airlines to aim at lower seat/mile* costs, mainly by utilizing larger aircraft. Conversely, their own economic survival requires that they utilize an aircraft of a limited capacity and, consequently, of lower aircraft/mile* costs, with which they can achieve profitable (higher) load factors.

In other words whenever an airline considers the acquisition of a new type of aircraft, or the deployment of an existing type on a certain route or segment, it immediately faces this conflict between the advantages, in lower seat/mile*costs, of the larger aircraft, as against the advantages, in lower aircraft/mile* costs, of the smaller aircraft.

A New Concept: COST PER PASSENGER/MILE*

It is suggested that this conflict can be reconciled by adopting a new concept of passenger/mile* cost. In principle, and provided there are no overriding outside constraints, airlines should decide in favour of operating the aircraft/frequencies/schedule combination which results in the lowest passenger mile* costs.

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* or kilometer

The evaluation of the passenger/mile* cost requires a procedure for the conversion of seats into passengers. This would make it possible to calculate the passenger/mile* cost from the traditional seat/mile* or aircraft/mile* cost.

The conversion factor (seats into passengers) is obviously a function of the particular market conditions: the total volume of demand and the pattern of its fluctuations over individual flights, existing schedules by all carriers, frequencies and types of aircraft.

THE ASNA FORMULA

The ASNA formula provides such a function. It defines the conversion factor in terms of the various market and operating factors enumerated above.

Consequently, the ASNA Formula can be utilized to measure Marginal Seat Utilization, MSU[a], and Marginal Acceptance, MA[b].

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* or kilometer

(a) MSU = The increase in the passenger load due to one additional seat on the aircraft

(b) MA = The percentage increase in the passengers accepted on an aircraft due to 1% increase in demand

It will be readily seen that these tools simplify, radically, the task involved in decision making in several fundamental areas in the field of air transport. The following are some important examples:

1. Airline decisions regarding the selection of aircraft, scheduling and deployment of fleets: The relationship between the Marginal Operating Cost - MC, the MSU, and the MA, determines the optimum aircraft and the optimum schedule for maximum profits.

2. The pricing of air transport: The relationship between the price elasticity, usually between -1.5 and -2.0, and the MA determines the price and the load factor for maximum profits.

3. From the MSU, the Marginal Traffic, MT[c], can be measured. Most passengers travel on a return basis, and thus a factor f can be established equal to the ratio of MT to MSU. f is usually between 1.3 and 1.6.

(c) MT = The increase in all passengers carried (total passenger traffic on the system) due to one additional seat on the aircraft

4. The assessment of public dissatisfaction related to inability to find seats on the chosen flights (overflows)

A distinctive feature of the ASNA formula is that it is both a macro and a micro econometric model.

Introduction to the Problem

The selection of an aircraft most suited for an airline's network and traffic is, without doubt, the most important decision it takes, entailing far reaching consequences which touch almost every function and activity and which span two decades or more of the airline's future.

In order to make such a selection, the airline carries out an assessment of all possible alternative aircraft that are available on the market (old as well as new).

Broadly speaking, the assessment covers the following areas:

1. Specifications and Performance of the various aircraft with a view to determining their suitability to the various routes and airports of the current network,

and any additions to that network planned for the future. Any operational limitations or constraints are identified and quantified, particularly on payloads. In addition, flight times and fuel consumption are determined.

2. The operating costs of the various aircraft. There are obviously numerous difficulties associated with this area of investigation but there are generally agreed procedures which most airlines follow in making such assessments, and experience has shown that they are sufficiently accurate for the purposes for which they are intended. These costs include the aircraft standing charges such as depreciation, interest, insurance etc... cockpit and cabin crew costs, other fixed costs and all variable operating costs. Flight times and fuel consumption figures, determined under item one above, from the basis for these estimates.

3. The revenue expected to be earned by the aircraft on the various routes and segments of the defined network. As will be shown herebelow, this item poses many serious difficulties, specifically, in estimating the passengers load that will be carried.

Obviously the final decision would be in favour of the aircraft which shows the highest difference in revenue as per item three above over cost as per item two above.

Any limitations imposed by item one above would either result in lowering revenue as in the case where the permissible load is reduced, or would result in increasing cost as in the case of a requirement for an extra landing en route. Both are therefore reflected in the difference between revenue and cost.

REASONS FOR VARIATION IN PASSENGER LOADS

For the same market, schedule and airline, one aircraft can show higher passenger loads than another for one or both of the following elements:

1. Greater passenger appeal associated with speed, range (non-stop capability), spaciousness, improved passenger amenities, reliability, safety record, etc...

2. Greater seating capacity enabling it to carry more passengers.

The first of these elements is mostly of a subjective nature and can best be assessed through analysis, observation and opinion surveys. But even when this is done, and some passenger preference factor is established, it would still be difficult to determine the exact amount of revenue that can be earned in consequence because it would obviously depend on the capacity of the aircraft and would therefore be related to the second element above.

As to the second element, the problem is one of converting seats into passengers, and the two are never the same as long as capacity is a constant while demand is variable, nor can they be related by a fixed ratio as long as conditions in any two given markets are never identically the same.

To illustrate, assuming we are comparing two aircraft, Aircraft A with 150 seats and an hourly cost of $3,200 and Aircraft B with 160 seats and an hourly cost of $3,300. The comparison resolves itself into determining whether the ten extra seats available on Aircraft B would result in carrying a sufficient number of additional passengers to pay for the 100 Dollars extra cost per flying hour and leave a surplus. If the answer to this question is positive then, other things being equal, the choice would certainly be in favour of Aircraft B as against Aircraft A.

But how does one determine the answer to such a question? Obviously there are flights which operate completely full and on which the airline is obliged to turn away passengers who would have wished to travel on the particular flight. The problem in such a case would be to determine the number of passengers thus turned away. One-? or Two-? or three etc up to the maximum of ten extra available seats.

In the search for a solution, it has first suggested that this question can best be answered by the Reservations Department. They would know how many passengers were placed on the "waiting list". But upon reflection it was clear that this could not be the case. In the first place, not all passengers accept to be placed on the waiting list. Also, many passengers wishing to travel do not contact the airline at all. They call their travel agent for their booking, and the travel agent would in turn contact the airline and obtain a negative response without having first announced the name of the passenger. In such a case the airline would have no record whatsoever of the turned away passenger or passengers. Equally, once the agent gets a negative response for a particular flight, he would not contact the airline again in respect of another passenger.

But even if it were possible to overcome these difficulties by setting up some system of recording all such unsatisfied requests, another problem arises, namely that all such information relates to the past while what is required is an assessment of a dynamic future. What is needed is to identify the cases where such overflows would take place in future years and the number of passengers that would be turned away in each such case, and it is evident that the obvious solution of taking each flight of the base year and increasing the number of passengers actually carried on it by the assumed percentage growth would not yield anything of value as the distribution of passengers over the days and the flights is affected by random factors.

Furthermore, on some flights the number of passengers actually recorded is not the number of those whose first choice was that particular flight. As long as there are flights which turned away passengers there are others which received such passengers and which consequently show a larger number of passengers than they would have if all passengers could be accommodated on their flight of first choice. There are also the effects of "No-shows", ship-side sales, etc...

Again the flights of an airline do not remain exactly the same from year to year and it would therefore be difficult to treat them in the manner suggested whereby each flight would be treated individually.

Above all it must be remembered that on any given route there are always more than one airline operating. Consequently, the passengers carried by one airline may be passengers whose first choice was another airline and who only travelled on the particular airline when they failed to get seats on the airline of their first choice.

When these questions were first encountered, the immediate and obvious reaction was to contact other airlines of greater experience in aircraft selection and find out what methods they had developed over the years.

Approaches were made to several such airlines. Their response came as a complete surprise. They all declared that they had no such formula and that the only way to deal with this particular problem was to use judgement based on experience.

At first the suspicion arose that it was only a matter of the airlines not wishing to give out something they had worked hard to develop and which, they considered, gave them a valuable tool which they would be ill advised to make freely available to others.

It was therefore decided to approach the manufacturers themselves who, it was presumed, because of the magnitude of their interest, would have developed a complete arsenal of such weapons. But they also gave the same disappointing answer, namely, that they were not aware of any such formulae and that, in effect, they considered such an investigation pointless as the problem did not lend itself to a scientific approach and could only be handled by judgement.

Other attempts were made by calling on the assistance of some leading aviation consultants. Their response were similar.

One of the manufacturers suggested that a possible solution, which he applied in such cases, was to take the six or seven peak weeks and assume that fifty percent of the extra seats available will be utilized and that the next fullest six or seven weeks will mean utilizing a quarter of the extra seats available. Evidently such a solution is totally arbitrary, and it completely ignores all the other relevant variables such as the number of the extra seats or the load factor achieved on the particular route, or the seasonal and directional variations, etc...

In the following paragraphs, specific examples are given to illustrate the wide range of executive decisions which, in the final analysis, can only be resolved by the conversion of seats into passengers.

Fields of Application

A- A decision is required on a proposal to enlarge the galley on one type of aircraft in order to offer a better service to its passengers at the cost of the loss of four seats on that aircraft. Obviously, no such decision can be properly taken without first assessing the finanacial loss which would result from the loss of the four seats. It is also obvious that the loss will not be equal to the revenue from four passengers on all the flights operated with the type of aircraft under consideration.

In other words, assuming that the average revenue per passenger per flying hour is 50 Dollars and assuming the aircraft has a daily utilization of ten hours, it cannot be assumed that the loss of the four seats will mean the loss of 4 times 50 Dollars times 10 hours i.e. 2000 Dollars per aircraft per day. This is due to the fact that not all the flights are full and that on those flights which carry less than a full complement of passengers, one or more of the lost seats will not actually mean loss of revenue. Thus we can only say at this stage that the loss of revenue resulting from the loss of the four seats is <u>less than 2000 Dollars</u>.

We can also say without further investigation that there will be some loss due to the loss of the four seats. Unless the airline is operating in a most uneconomical manner, there are bound to be certain days and certain hours when the demand will reach a level at which the missing four seats will be translated into loss of passengers and therefore into loss of revenue.

Thus we can say that the loss due to the elimination of four seats is somewhere between 0 and 2000 Dollars per aircraft per day.

Evidently this is too wide a margin. If it should prove to be only 20 Dollars, say, there would be no argument about enlarging the galley, because it can be safely assumed that as a result of the improved service to the passengers there will be at least one extra passenger per day who will fly with this airline for a half hour sector because of the attraction of the improved passenger service. The revenue from such an additional passenger on a half hour sector would amount to 25 Dollars and would therefore more than comensate for the loss of the four seats.

On the other hand, should the loss of revenue prove to be of the order of $ 1000 per aircraft per day, then the improved galley must attract two extra passengers on every flight, and as some flights will be full, the remaining flights must attract proportionately more than two extra passengers to compensate.

It is essential therefore to determine, with reasonable exactitude, the loss of revenue associated with the loss of seats.

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B- A decision is required on a choice between the DC8-62 and the DC8-50 aircraft. The first aircraft has thirty more seats but costs two million Dollars more to purchase. Its hourly cost is $ 420 higher, including the higher depreciation, interest, and insurance resulting from the higher initial price.

The two aircraft would therefore compare in the following manner:

Table II

	DC8-62	DC8-50
Seats Available	180	150
Hourly Costs (Dollars)	3420	3000

The airline has two alternative comparisons to make:

B.1- To compare the two aircraft on the basis of equal frequency, say, five per week or per day for each of the two aircraft, and determine whether the larger aircraft can earn sufficient revenue with the 30 extra seats to pay for the additional cost of \$ 420 per flight per hour.

or, alternatively,

B.2- To compare the two aircraft on the basis of equal capacity, say, 900 seats per day or per week, which would mean operating five flights with the larger aircraft against six with the smaller; and determine whether the saving in cost of \$ 900, representing the difference between six one hour flights at \$ 3000 and five one hour flights at \$ 3420, would not be more than wiped out by the loss of revenue due to the loss of one frequency by the larger aircraft.

It should be emphasized in respect of these two comparisons that the answers required should cover not only one year but the whole operating life envisaged for the particular aircraft.

It can be readily seen that, assuming that the two aircraft are operated with equal frequency, the smaller aircraft is more likely to show better results during the first year or two because it is unlikely that demand will exceed its capacity on too many occasions. But as traffic grows, in the normal course of events, these occasions will become more and more numerous and the capacity of the larger aircraft will come into higher and more frequent use.

Furthermore it will be noted that increasing the frequency of operation with the smaller aircraft, whenever necessary, will produce a smaller percentage increase in capacity and would therefore result in a smaller drop in load factors. The following table illustrates this point:

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TABLE III

YEAR	TRAFFIC	AIRCRAFT A			AIRCRAFT B			
		FREQ	SEATS	L.F.	FREQ	SEATS	L.F.	
1	450	6	900	50	5	900	50	EQUAL
2	509	6	900	57	5	900	57	EQUAL
3	575	6	900	64	5	900	64	EQUAL
4	649	7	1050	62	6	1080	60	LOWER
5	734	8	1200	61	7	1260	58	LOWER
6	829	9	1350	61	8	1440	58	LOWER
7	937	10	1500	62	8	1440	65	HIGHER
8	1059	11	1650	64	9	1620	65	HIGHER
9	1196	13	1950	61	11	1980	60	LOWER
10	1352	14	2100	64	12	2160	63	LOWER
11	1528	16	2400	64	13	2340	65	HIGHER
12	1726	18	2700	64	15	2700	64	EQUAL
13	1951	20	3000	65	17	3060	64	LOWER
14	2204	23	3450	64	19	3420	64	HIGHER
15	2491	26	3900	64	22	3960	63	LOWER
16	2814	29	4350	65	25	4500	63	LOWER

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Assumptions

1- Frequency will be increased whenever load factor exceeds 65 percent.

2- Traffic will increase annually by 13 percent.

From the above table it can be seen that of the sixteen years for which the calculations have been made, representing the generally acceptable life of an aircraft,

- 4 years showed equal load factors
- 8 years showed lower load factors for the larger aircraft
- 4 years showed higher load factors for the larger aircraft

Furthermore, the smaller aircraft means a higher frequency and this is always beneficial in terms of attracting passengers and stimulating traffic.

Against these advantages in favour of smaller aircraft it should be remembered that larger aircraft have the advantage of a lower break-even load factor and it is therefore necessary to compare quantitatively the

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two elements in order to arrive at a net result.

In the specific example we have been examining, it will be seen that the comparison on the basis of <u>equal frequency</u>, as suggested in the first alternative, can be reduced to the specific question of determining the difference between the average passengers on the five flights of the larger aircraft and the average on those of the smaller aircraft.

We have already seen that the difference in hourly costs is $ 420 which is the difference between $ 3420 and $ 3000. This means 8.4 additional passengers per flight on the basis of a revenue rate of $ 50 per passenger per hour, i.e., a matter of whether the thirty extra seats available on the larger aircraft will mean an extra load of 8.4 passengers on the average flight.

Similarly, in considering the second alternative of <u>equal capacity</u>, we have already determined that the difference in total cost of all flights is $ 900, and as we have been assuming an hourly passenger revenue rate of 50 Dollars, the question becomes whether the smaller aircraft will carry

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on its six flights 18 passengers more than what the larger aircraft will carry on its five flights.

The answers to these questions would obviously depend, very largely, on the following two factors:

1. The load factors at which Airline X and the other airlines are operating: the higher the load factor, the more efficient the larger aircraft.

2. The variance of the load factor: again, the higher the variance, the more efficient the larger aircraft.

The validity of statement under 1. above is fairly obvious and does not require further comment. The second statement, however, is not so self evident and we therefore produce, herebelow, an illustration:

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TABLE IV

Flight	Distribution A (High Variance) Average Pax	Distribution B (Low Variance) Average Pax
1	50	60
2	60	65
3	70	70
4	80	80
5	90	80
Average	70	70

The two distributions given above have the same average values but differ in their variance. If we compare the operation of two aircraft on two routes represented by these two distributions, the first of size 75 seats and the second of size 80 seats, the number of passengers turned away because of lack of capacity on the aircraft will be as follows:

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TABLE V

Aircraft	Flight	Passengers Turned Away: Distribution A	Passengers Turned Away: Distribution B
75 Seater			
	1	none	none
	2	"	"
	3	"	"
	4	5	"
	5	15	5
	Total	20	5
80 Seater			
	1	none	none
	2	"	"
	3	"	"
	4	"	"
	5	10	"
	Total	10	0

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It can thus be seen that the larger aircraft shows a greater revenue gain when traffic distribution has a high variance. In this particular case the larger aircraft showed a gain of ten passengers in the high variance distribution but only five in the low variance distribution.

This particular case has been chosen as the subject of Illustration II on page 76.

The Summary of Results given on pages 78 and 79 demonstrates that the gain by the larger aircraft operating equal frequencies varies substantially depending on changes in market conditions. Under certain conditions, the gain becomes sufficient to cover the higher cost of operation.

Equally, it can be seen that, on the basis of equal capacity, the total gain by the smaller aircraft varies, but with a lesser magnitude, with changes in market conditions. Therefore no general judgement can be made for or against a particular aircraft. It will always depend on the particular airline's network, different route traffic densities and competition.

C- In a bilateral negotiation between two countries agreement was reached between the two sides that the expected traffic would amount to 1000 passengers per week in each direction. This would mean that each airline should mount capacity equal to 1000 seats, or a total of 2000 seats by the two airlines, resulting in a combined load factor of fifty percent.

A problem arose however when discussion turned to the types of aircraft and the frequencies to be mounted by each airline. One of them had 747's with a capacity of 340 seats while the other had 707's with 140 seat capacity. The second airline took the position that it should be allowed 7 weekly flights making a total of 980 seats, and that the other airline should be allowed only three flights of a total capacity of 1020 seats.

The wide body operator objected to this proposal on the grounds that the vast difference in frequency between them give the other carrier a tremendous advantage. To this the other airline countered by suggesting that the wide body operator had two advantages, the greater passenger appeal of the wide bodied aircraft, and also, the lower cost per seat on the wide body jet.

The argument thus turned into an assessment of the relative advantages of frequency against capacity, which was the subject of Case B above, and of the significance of the passenger appeal element.

It would be generally readily conceded that the question of passenger appeal is not a matter falling properly within the sphere of bilateral negotiations but once the principle of predetermination is accepted, it would certainly be important to determine the significance of the difference in frequency.

D- In the edition of the 21st August, 1976, of Flight Magazine, the following statement appeared:

"With the same engines and flight-deck crew as the TriStar 500, the DC-10-30R, (i.e. equipped with a RollsRoyce engine), would carry about thirty more passengers over similar stages. The TriStar 500 appears to have the edge in aircraft-mile costs, but the airlines have traditionally placed more importance on seat-mile cost (although economic recession has taught that 30 more seats do not mean thirty more full seats). The DC-10 leads in seat-mile costs,...."

Obviously the observation that comes immediately to mind is that it would be very useful, on a matter of such importance as investment in equipment purchases of this magnitude, to provide airlines with a more scientific and serious method to assess the relative importance of aircraft-mile costs against seat-mile costs, than to rely simply on "tradition".

Equally, if economic recession has "taught" that 30 more seats do not mean 30 more full seats, it would be extremely useful to know how many full seats do these 30 seats actually and precisely mean.

E- An airline is considering a complete reequipment program and finds that the Boeing 727-200 aircraft is the most suitable for the majority of its routes. On the remaining routes it suffers from inadequate range capability. On such ranges, its passenger capacity drops from the normal level of 150 seats to about 130. The airline has therefore two choices; either to decide for a mixed fleet of 727-200 and, say, 707-320 which has sufficient range for the remaining sectors, but in which case the airline will suffer a sizeable increase in costs because of the mixture in types and the higher operating costs of the 707-320 as compared to the 727-200, or, alternatively, decide on a uniform fleet and accept the penalty of reduced payloads on the longer sectors.

It is therefore necessary to determine two unknowns:

- The magnitude of the additional expenditure arising from a mixed fleet operation and the higher costs of the 707-320 type, as against the 727-200.

- The loss of revenue resulting from the loss of 20 seats.

As we have pointed out before, the first unknown is relatively easy to determine, especially the estimation of the higher operating costs of the 707-320 type aircraft. The estimation of the extra costs

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relating to the mixing of types, is more complex and less exact. These are, in fact, several components most of which can be assessed with sufficient accuracy. The others, however, are difficult to quantify, but the magnitude of these items is relatively small and, therefore, any estimation errors can be ignored.*

The second unknown, however, that of assessing the loss of revenue, is subject to the same uncertainties and questions that have been outlined before.

F- An aircraft designer finds that a certain modification would make an aircraft carry 20 percent more seats but that the cost of operation would, as a consequence, increase by 4 percent. Is such a modification economically attractive?

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* An ingenious formula has been suggested by some aviation researchers for the assessment of the extra costs arising from mixed fleet operations:

$$C' = 50/N \text{ percent}$$

where C' is the percentage increase in costs and N is the number of aircraft in the fleet. Obviously, there is no scientific method of assessing the validity of this formula.

The answer to this question rests of course on the number of passengers that will be carried as a result of this modification, i.e., because of the 20 percent extra seats. If the revenue from these passengers is greater than the 4 percent increase in cost, then, obviously, the modification is worthwhile.

Again it should be stressed that the answer needed in such cases should relate to the whole working life of the aircraft and not to one or two years only.

G- Larger aircraft have, generally, lower seat costs, mainly because certain cost elements do not increase at all with increases in size or increase on a much smaller scale (economies of scale).

Air fares are usually determined by the International Air Transport Association - IATA. They are also subject to approval by the respective governments. It is also generally accepted that Air Travel is price elastic. Price elasticity normally ranges between - 1.5 and - 2.0.

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It is desired to reduce fares in a manner which would bring to the public some of the benefit accruing from the improved economics of the larger aircraft, and, simultaneously, induce a growth in demand with obvious benefits to passenger, operator and manufacturer alike.

It is therefore necessary to measure such improvement in economics. Clearly, it is not, simply, a matter of assessing the reduction in the unit cost of production. It is a composite figure of the lower unit cost as against the lower unit revenue, as the following example will demonstrate. (Without considering, at this stage, the effects on demand of a lower price.)

TABLE VI

	Aircraft A	Aircraft B
Number of Seats	150	180
Cost of One Hour Flight	$3000	$3300
Revenue of One Hour Flight*	$3200	$3500
Cost Per Seat	$20	$18.33
Revenue Per Seat	$21.33	$19.44
Profitability Rate	0.0665	0.0606

* At $ 50 per passenger/one hour flight

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The figures shown in Table VI indicate that the 180 seater aircraft has a lower unit cost by about 8.3 percent but, against this advantage, it has a lower unit revenue by 8.9 percent. Any reduction in fares can only be considered in the light of these two figures, and in this particular case no reduction can be justified.

If the figures in Table VI are modified as shown in Table VII, below, there would obviously be valid grounds for a reduction in fares.

TABLE VII

	Aircraft C	Aircraft D
Number of seats	150	180
Cost of One Hour Flight	$3000	$3300
Revenue of One Hour Flight*	$3200	$3700
Cost Per Seat	$20	$18.33
Revenue Per Seat	$21.33	$20.56
Profitability Rate	0.0665	0.1266

* At $ 50 per passenger/one hour flight

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In this case, the larger aircraft shows 8.3% lower unit cost, but only 3.6% lower unit revenue and it is therefore possible to reduce fares by the difference and still maintain the same rate of profitability measured as:

$$\frac{\text{Revenue} - \text{Cost}}{\text{Cost}}$$

Thus, and in order to maintain the same profitability rate of 6.65%, aircraft D must earn \$ 3520. It was estimated however that it can earn \$ 3700, on the basis of current fares. It can therefore be concluded that fares may be reduced by 4.86 percent.

Obviously, other factors are usually taken into consideration in such decisions and would usually lead to a modification of this figure, but the margin is there and is available for this purpose.

The above analysis shows very clearly that the decision turned upon the revenue which can be earned by the larger aircraft. Aside from any difference in the passenger appeal of the two aircraft, which

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is not an issue at this point, it is a matter of assessing the extra passengers which may be carried because of the extra seats.

In Tables VI and VII the only figure that was changed was the revenue of the larger aircraft. The figure we have been using for hourly revenue per passenger was \$ 50, which means that in Table VI the larger aircraft will have to carry 6 passengers more, in order to earn the extra \$ 300, and, in Table VII it will have to carry 10 extra passengers in order to earn the extra \$ 500.

Thus it will be seen that our conclusions were totally dependent upon these two estimates. In other words, the basic question is whether the 30 extra seats will result in the carriage of 6 or 10 extra passengers. Again this is the question discussed in the above examples especially B on page 18.

The Effects of Price Elasticity

If we now add the effect of price elasticity, assumed at, say, -1.65, the reduction of fares by 4.86 percent would translate itself into an increase in demand of 4.86 times 1.65 which equals 8.019 or, say 8%.

Evidently the smaller aircraft can only capture a smaller share of this increase, as compared to the larger aircraft. The difference in revenue would, therefore, be greater than the $ 320 which was arrived at in the above calculations. If it were possible to measure this advantage with precision, the exact consequences can be quantified and the optimal decision, regarding the proposed reduction in fares, taken.

H- An airline has a mixed fleet consisting of 17 DC9s each equipped with 110 seats and nine DC8-62s, each equipped with 180 seats. Of the nine DC8-62s, five must necessarily be deployed on certain routes where the range requirement exceeds the capability of the DC9. A decision is required regarding the routes on which the remaining four DC8-62 aircraft will be utilized.

The first reaction would obviously be that the larger aircraft must be used on those routes on which the higher load factors were achieved. Further examination, however, would show that this is not necessarily

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correct and that various other considerations must be taken into account such as constraints on traffic rights limiting capacity and/or frequency, traffic flow variances on the route, etc...

It is possible, for example, to find, after proper analysis, that the DC8 would be better utilized on a higher frequency route so that the extra capacity it offers can be used to reduce flights and thus save costs.

Also, it maybe found that the DC8 can best be used on routes with frequency limitations.

Again, analysis may show that the DC8 can best be operated on routes with high traffic flow variance although such routes show a comparatively lower average load factor. Tables IV and V of example B (see pages 25 and 26) illustrate the significance of variance in this particular context.

The Search for a Solution

An airline executive faces this type of problem almost every day. Without a reliable scientific method of measurement, he is obliged to resort to such subjective approaches as judgement, concensus of opinion, etc.

Obviously, this is a most unsatisfactory state of affairs. The search was thus started for a more satisfactory solution. In 1969, the basic concept of the ASNA formula was established. It then took about two years to develop the full formula and test its validity, reliability and scope of applicability.

In its final form, the ASNA Formula provides a scientific method for the measurement of the impact on revenue and earnings of a change in capacity of aircraft and/or in frequency of operation.

Specifically, the applications of the Formula extend to:

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1- Choosing the type or types of aircraft most suited to an airline's network and different route traffic densities. (c.f. Example B page 17 and Example D page 29)

2- Determining the optimum combination of frequency and capacity on a given route or route segment. (c.f. Example B page 17 and Example C page 28)

3- Determining the most economic deployment of an available fleet to the airline's network. (c.f. Example H page 38)

4- Determining the optimum fleet composition and mix, i.e., how many types and in what proportions. (c.f. Example E page 30)

5- Evaluating a proposed modification resulting in an alteration in the capacity of an aircraft. (c.f. Example A page 15 and Example F page 32)

6- Assessing the effects of alternative route authorizations and constraints. (c.f. Example C page 28)

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7- Evaluating the relationship between the size of an aircraft, its seat costs, and fares. (c.f. Example G page 33)

Statement of Inputs

The following is the input form for the application of the ASNA formula:

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INPUT FORM - ASNA FORMULA

(Sector S)

0. Base Period P

0.1. Data Relating to Airline X

Average Seating on Aircraft	: ....
Average Weekly Frequency	: ....
Frequency Distribution of Passenger Load Factor on Flights of Airline X during Period P	
90.0 - 100%	: ....
80.0 - 89.9%	: ....
70.0 - 79.9%	: ....
60.0 - 69.9%	: ....
50.0 - 59.9%	: ....
40.0 - 49.9%	: ....
30.0 - 39.9%	: ....
20.0 - 29.9%	: ....
10.0 - 19.9%	: ....
00.0 - 9.9%	: ....

0.2. Data Relating to All Airlines on Sector S

Average Seating on Aircraft	: ....
Average Weekly Frequency	: ....
Combined Passenger Load Factor	: ....

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1. Alternative One

1.1. Data Relating to Airline X

Average Seating on Aircraft : ....
Average Weekly Frequency : ....

1.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft : ....
Average Weekly Frequency : ....

2. Alternative Two

2.1. Data Relating to Airline X

Average Seating on Aircraft : ....
Average Weekly Frequency : ....

2.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft : ....
Average Weekly Frequency : ....

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3. Growth Rates

3.1. For Airline X under Alternative One : ....
3.2. For Airline X under Alternative Two : ....
3.3. For Total Market regardless of Alternative : ....

Explanations and Definitions

Sector S

Sector means a pair of points, in a given direction, regardless of whether the routing is with or without intermediate stops, and regardless of whether the flight originates or terminates at either of them. A flight with the routing Rome-Paris-New York-San Francisco would have the following pairs of points:

Rome-Paris
Paris-New York
New York-San Francisco
Rome-New York
Paris-San Francisco
Rome-San Francisco

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Therefore, and assuming that the carrier concerned has the right to carry traffic on every one of these pairs, the ASNA formula would have to be applied separately to each pair and in each direction. All flights by Airline X on the pair under consideration would be included. All flights by other carriers on that pair and in that direction would also be included when collecting data for "All airlines on the Sector".

It should be noted, however, that when considering, for example, the Rome-Paris sector in the above illustration, a hypothetical aircraft should be assumed whose seating capacity will be a fraction of the actual aircraft equal to the ratio represented by the Rome-Paris passengers to the total passengers carried on the aircraft on that particular sector.

Example: Assume that during the flight Rome-Paris, there were 39 pax going only from Rome to Paris out of a total of 90 pax on board the aircraft.

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Then if the total seats on the aircraft is 135, we would assume that the carrier was operating a smaller aircraft whose capacity equals

135 X 39/90 = 58.5 , and on which 39 pax only were carried. Obviously, this smaller aircraft would have the same pax load factor as the original one.

If Airline X operates several flights on this sector, the above procedure must be followed for them all. Obviously, this can be done for each flight separately, or, globally by calculating total Rome-Paris pax on all the flights and then expressing this number as a fraction of the total pax on board these same flights.

The total capacity of all these flights is then calculated, and a fraction of it, equal to the pax fraction, is derived. This number is then divided by the frequency to arrive at the average seating capacity as we shall see below.

For data relating to all airlines, we would include all flights serving the sector under consideration and without apportionment of the capacity over the various origin/destination combinations as has been done for Airline X.

The following examples will illustrate the variety of flights which will be included.

Airline	Routing	Frequency
aaa	Athens-Rome-Paris-London	7
bbb	Rome-Geneva-Paris	5
ccc	Beirut-Rome-Paris-New York	3
ddd	Karachi-Rome-Paris-London-Montreal	4
eee	Cairo-Rome-Paris-Los Angeles	2
fff	Rome-Paris	5
ggg	Athens-Rome-Geneva-Frankfurt-Paris	3
hhh	Rome-Paris-London	7

(O) Base Period P

The calendar year represents the complete cycle of airline operations, while the scheduling and product marketing unit is the week.

The week is also of special significance in terms of the interchange of passengers between flights. Market observations and research indicate that such passenger interchange, originating in flight overflows, takes place on a scale inversely related to the time interval between the flight of their first choice and the other available flights of the same airline or of other airlines serving the particular market, and that beyond a time span of one week, the interchange becomes practically negligible.

The week was therefore adopted as the standard unit of time for the application of the ASNA formula. This entails that the input data for the base year must be converted into weekly units. Obviously, averages for periods of time or for a number of flights would suppress

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the effects of chance and of basic demand fluctuation. Consequently, the weekly units representing the Base Year (or any other period) can be, if a certain loss of accuracy is acceptable, any of the following alternatives which have been arranged in order of level of accuracy.

1. The most satisfactory result is obtained by dividing the base year into fifty-two weeks and making a separate application for each of these weeks, resulting in a total of 104 applications to cover the two directions.

2. Almost equally satisfactory would be the random selection of, say, twelve out of the fifty-two weeks of the base year and applying the formula to each of the chosen weeks. This means 24 applications.

3. Next would be the dividing of the year into twelve months and making a separate application for each month. Under this alternative it is important to remember that all data

on frequency must relate to weekly frequency as an average during each month. This, again, requires 24 applications for both directions.

4. It is also possible to divide the year into a few parts (say, 2,3, or 4 etc) e.g. On-Season, Off-Season, and Shoulder, and thus require only a reduced number of applications, but here again, the frequency must be the weekly frequency as explained under item 3, above. In this case, 3 applications for each direction are required; a total of 6.

5. It is equally possible to divide the year first into its fifty two weeks and then regroup them into any number of homogenous groups, which need not all be of equal size, and then calculate averages for each of these groups and apply the formula to them. The two directions could be grouped differently.

6. Finally, the whole year could be taken as one unit and the averages calculated as required by the ASNA Input Form. This means two applications in all.

For clarity, we point out that the difference between alternatives 4. and 5. lies in the fact that under 4. the weeks in each group are in sequence (consecutive) while this is not the case under alternative 5. To further illustrate this point we give the following examples:

Under alternative 4., the year could be divided into three parts as follows:

Part 1: Oct 14th - Mar 16th = 22 weeks
Part 2: Mar 17th - Jun 8th = 12 weeks
Part 3: Jun 9th - Oct 12th = 18 weeks

While under alternative 5., the year could be divided into the following groups of weeks:

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Group 1 : Containing 23 weeks as follows:

8 weeks Oct 14th - Dec 8th

9 weeks Jan 20th - Mar 23rd

6 weeks Apr 28th - Jun 8th

Group 2 : Containing 17 weeks as follows:

1 week Dec 9th - Dec 15th

2 weeks Dec 23rd - Jan 5th

1 week Jan 13th - Jan 19th

1 week Mar 24th - Mar 30th

1 week Apr 7th - Apr 13th

1 week Apr 21st - Apr 27th

3 weeks Jun 9th - Jun 29th

3 weeks Jul 14th - Aug 3rd

3 weeks Aug 18th - Sep 7th

1 week Oct 6th - Oct 12th

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Group 3 : Containing 12 weeks as follows:

1 week	Dec 16th	- Dec 22nd
1 week	Jan 6th	- Jan 12th
1 week	Mar 31st	- Apr 6th
1 week	Apr 14th	- Apr 20th
2 weeks	Jun 30th	- Jul 13th
2 weeks	Aug 4th	- Aug 17th
4 weeks	Sep 8th	- Oct 5th

The general principle underlying these divisions or groupings is that the accuracy of the ASNA formula increases with a higher degree of homogeneity between the weeks for which average figures are being utilized. The term homogeneity in this context refers to the absence of major differences or changes, for the whole market, between one week and another in terms of:

1- Frequency
2- Size of Aircraft
3- Total Demand

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This would explain the order of preference established above. It should be noted, in this context, that the six alternatives are listed in descending order of accuracy, which is, simultaneously, in ascending order of required time, effort and cost.

Under the first alternative, every set of conditions would require the compilation of 104 sets of figures (two sets for each week, one outbound and one inbound on the specified sector), while under the second alternative only 24 are used (two for each month). At the other end of the scale, in alternative 6, only two sets are needed.

In order to gain a better appreciation of the inverse relationship between relative accuracy and relative cost of the various alternative methods of compiling the input data for the Base Period, several test comparisons were made.

As one would have expected, the results demonstrated that the more homogenous the figures which are grouped together, the closer is the agreement between the results obtained from the "averaged week" and those of the "average of the individual weeks".

In other words, if we compare, for example, the results obtained from applying the ASNA formula to one average week representing a whole year (alternative 6) with the average of twelve results obtained, from twelve weeks each representing an average for one month (alternative 3), we would find that the smaller the variance between the various monthly averages, the lesser the divergence between the two results.

Specifically, it was noted that the grouping of flights over any time interval would not affect the results in any appreciable manner as long as the load factor, for all carriers on the market, remains relatively stable within that interval.

At this point, it is useful to refer to a refinement in respect of the Base Period.

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Normally, the Base Period should cover the last twelve months for which statistics are available, regardless of the alternative chosen in terms of length of period or grouping and selection.

There are cases however when the last twelve months for which statistics are available are not completely normal, having been affected by major social, economic or political events.

In such cases it would be advisable to start from the twelve months preceding such events, but, obviously, the growth rates under item 3 of the Input Form (page 35), must be adjusted so as to reflect the additional growth during the "abnormal" twelve months that were excluded.

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(0.1) Data Relating to Airline X

(0.1.1) Average Seating on Aircraft

0.1.1.1 Add all the seats on all the flights flown by Airline X on Sector S during the Base Period P.

0.1.1.2 Divide 0.1.1.1 by 0.1.2.1 (below) to arrive at average seating per flight.

0.1.1.3 Determine total passengers travelling on all those flights whose origin and destination is identical with Sector S.

0.1.1.4 Determine all passengers travelling on all those flights regardless of origin and destination.

0.1.1.5 Divide 0.1.1.3 by 0.1.1.4 and multiply by 0.1.1.2 to arrive at "Apportioned Capacity of Aircraft".

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(0.1.2) Average Weekly Frequency

0.1.2.1 Determine number of all flights operated by Airline X on Sector S during Period P.

0.1.2.2 Determine number of weeks in Base Period P.

0.1.2.3 Divide 0.1.2.1 by 0.1.2.2 to arrive at average weekly frequency.

(0.1.3) Frequency Distribution of Load Factor

0.1.3.1 Take the passenger load factors of all flights included in 0.1.1.1 above.

0.1.3.2 Classify them by intervals of 10 percentage points as shown in the input sheet. The calculation of "Apportioned Capacity of Aircraft" as in 0.1.1.5 above does not affect these figures as the load factor remains the same.

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0.1.3.3 Convert into a relative frequency distribution. (The total always being one)

(0.2) Data Relating to All Airlines on Sector S

(0.2.1) Average Seating on Aircraft

0.2.1.1 Add all the seats on all the flights flown by all airlines, other than Airline X, on Sector S during Base Period P.

0.2.1.2 Multiply 0.1.1.5 by 0.1.2.1 to arrive at total "Apportioned" seats offered by Airline X.

0.2.1.3 Add 0.2.1.1 and 0.2.1.2 to arrive at total seats offered by all airlines including X.

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0.2.1.4 Divide 0.2.1.3 by 0.2.2.2 (below) to arrive at average seating per flight for all airlines, including X.

(0.2.2) Average Weekly Frequency

0.2.2.1 Determine number of all flights operated by all airlines, other than X on Sector S during Base Period P.

0.2.2.2 Add 0.1.2.1 to arrive at total flights in the Sector.

0.2.2.3 Divide by 0.1.2.2 to arrive at Average Weekly Frequency.

(0.2.3) Combined Passenger Load Factor

0.2.3.1 Determine Average Passenger Load Factor on all flights of other airlines.

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0.2.3.2 Multiply 0.2.1.1 by 0.2.3.1 to arrive at passengers carried by other airlines.

0.2.3.3 Add 0.2.3.2 and 0.1.1.3 to arrive at total passengers carried by all airlines.

0.2.3.4 Divide 0.2.3.3 by 0.2.1.3 to arrive at the combined passenger load factor.

(1) Alternative One:

Both alternatives relate to the same period of time in the future. The total market is assumed to remain constant over the two alternatives. If a different set of market conditions is to be examined, then a different application would have to be made. The only differences between the two alternatives relate to changes in the operations of Airline X and the other airlines, as well as in the relative market position of Airline X as will be shown in the following comments.

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(1.1) <u>Data Relating to Airline X</u>

An actually planned, or hypothetical, schedule must be taken as the basis for calculations.

1.1.1 <u>Average Seating on Aircraft</u>

Follow same steps as under 0.1.1 above, using the planned or hypothetical schedule.

1.1.2 <u>Average Weekly Frequency</u>

Follow same steps as in 0.1.2

(1.2) <u>Data Relating to All Airlines on the Sector</u>

The Base Period inputs are modified in accordance with known planned changes of the programs of other

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airlines plus any which may be expected and which it is desired to consider and assess the effects thereof.

1.2.1 <u>Average Seating on Aircraft</u>

Follow same steps as in 0.2.1

1.2.2 <u>Average Weekly Frequency</u>

Follow same steps as in 0.2.2.

(2) <u>Alternative Two</u>:

A different operating program, actually planned or hypothetical, is being examined under Alternative Two, but without change in the overall market conditions assumed for Alternative One.

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(2.1) <u>Data Relating to Airline X</u>

2.1.1 <u>Average Seating on Aircraft</u>

As in 1.1.1

2.1.2 <u>Average Weekly Frequency</u>

As in 1.1.2

(2.2) <u>Data Relating to All Airlines on the Sector</u>

2.2.1 <u>Average Seating on Aircraft</u>

As in 1.2.1

2.2.2 <u>Average Weekly Frequency</u>

As in 1.2.2.

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(3) <u>Growth Rates</u>

(3.1) <u>For Airline X under Alternative One</u>

The assumed or expected variation in demand for travel on Airline X. This would be an assigned value which reflects any differences between the changes in total market demand and in the share of Airline X. Specifically, if the figure given under 3.1 is equal to that under 3.3, it would reflect the assumption that the demand for the flights of Airline X will follow the general market trend. If it is smaller, then demand for X is falling compared to the total market. Conversely, if it is higher, then the share of X, out of total demand, is improving.

The magnitude of 3.1 as compared to 3.3 (and similarly, for 3.2 compared to 3.3) reflects, therefore, changes in competitive position due to changes in type

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(passenger appeal) of aircraft, in airline image, reliability, service, regularity, etc... or marketing policy, but <u>not</u> changes in size or frequency which are accounted for by the ASNA formula. This is, of course, unless the change in size or frequency is of such magnitude as to change the whole position of the airline in that particular market, in terms of its image and status.

(3.2) Refer to 3.1 above

(3.3) Refer to 3.1 above.

Statement of Outputs - ASNA Formula

The following table shows the outputs of the ASNA formula:

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	Average Passengers Per Flight - Airline X	Passenger Load Factor - Airline X	Share of Total Market - Airline X
Base Period	....	....	....
Alternative One	....	....	....
Alternative Two	....	....	....
Change Per Flight	....	....	....
Change Per Flights	....	....	....

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ILLUSTRATION I

In order to illustrate the effectiveness of the ASNA formula two series of applications were made.

The first reflected a market with a high variance in average loads as shown herebelow:

Passenger Load Factor	Relative Frequency
95%	.02
85%	.06
75%	.10
65%	.14
55%	.18
45%	.18
35%	.14
25%	.10
15%	.06
5%	.02

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The second reflected a market with a relatively low variance as shown below:

Passenger Load Factor	Relative Frequency
95%	0
85%	0
75%	0
65%	0
55%	0
45%	1
35%	0
25%	0
15%	0
5%	0

For each of the two markets, a series of market demand conditions (D) were assumed as follows:

1- $D + 10\% = D \times (1.1)$
2- $D + 20\% = D \times (1.2)$
3- $D + 30\% = D \times (1.3)$
4- $D + 40\% = D \times (1.4)$
5- $D \div 50\% = D \times (1.5)$

6- D + 60% = D x (1.6)
7- D + 70% = D x (1.7)
8- D + 80% = D x (1.8)
9- D + 90% = D x (1.9)
10- D + 100% = D x (2.0)
11- D + 150% = D x (2.5)
12- D + 200% = D x (3.0)
13- D + 250% = D x (3.5)
14- D + 300% = D x (4.0)

Next, an incremental change of 1% was assumed for each case:

1- D x (1.1) + 1% = D x (1.111)
2- D x (1.2) + 1% = D x (1.212)
3- D x (1.3) + 1% = D x (1.313)
4- D x (1.4) + 1% = D x (1.414)
5- D x (1.5) + 1% = D x (1.515)
6- D x (1.6) + 1% = D x (1.616)
7- D x (1.7) + 1% = D x (1.717)
8- D x (1.8) + 1% = D x (1.818)
9- D x (1.9) + 1% = D x (1.919)
10- D x (2.0) + 1% = D x (2.02)
11- D x (2.5) + 1% = D x (2.525)

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12- D x (3.0) + 1% = D x (3,03)
13- D x (3.5) + 1% = D x (3,535)
14- D x (4.0) + 1% = D x (4,04)

Finally, in each case, a comparison was made between the results obtained with the regular size aircraft (150 seater) and an aircraft <u>one seat</u> larger.

The fifty six results are provided herewith, and are also shown in the attached composite graph.

Needless to emphasize that these results are only valid to the extent that the inputs reflect prevailing market conditions. Any change in these would lead to different results. This is where the ASNA formula scores. It can respond to a wide range of variations in airline and market conditions.

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Illustration I-Summary of Results

Marginal Seat Utilization

& Marginal Acceptance

High Variance

L.F.%	MSU	M.A.
54.0	.128	.780
57.7	.162	.738
61.2	.198	.696
64.3	.237	.654
67.2	.276	.618
69.9	.316	.575
72.3	.356	.531
74.5	.396	.498
76.4	.434	.465
78.2	.471	.431
84.9	.629	.301
89.0	.749	.201
91.4	.837	.144
92.9	.903	.100

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Illustration I-Summary of Results

Marginal Seat Utilization

& Marginal Acceptance

Low Variance

L.F.%	MSU	M.A.
49.3	.029	.951
53.5	.046	.924
57.6	.068	.893
61.4	.096	.853
65.1	.130	.811
68.5	.171	.763
71.6	.212	.715
74.5	.259	.663
77.2	.308	.617
79.6	.358	.566
88.1	.597	.349
92.4	.772	.174
94.4	.880	.076
95.1	.945	.020

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ASNA FORMULA

ILLUSTRATION I

MARGINAL SEAT UTILIZATION AND MARGINAL ACCEPTANCE

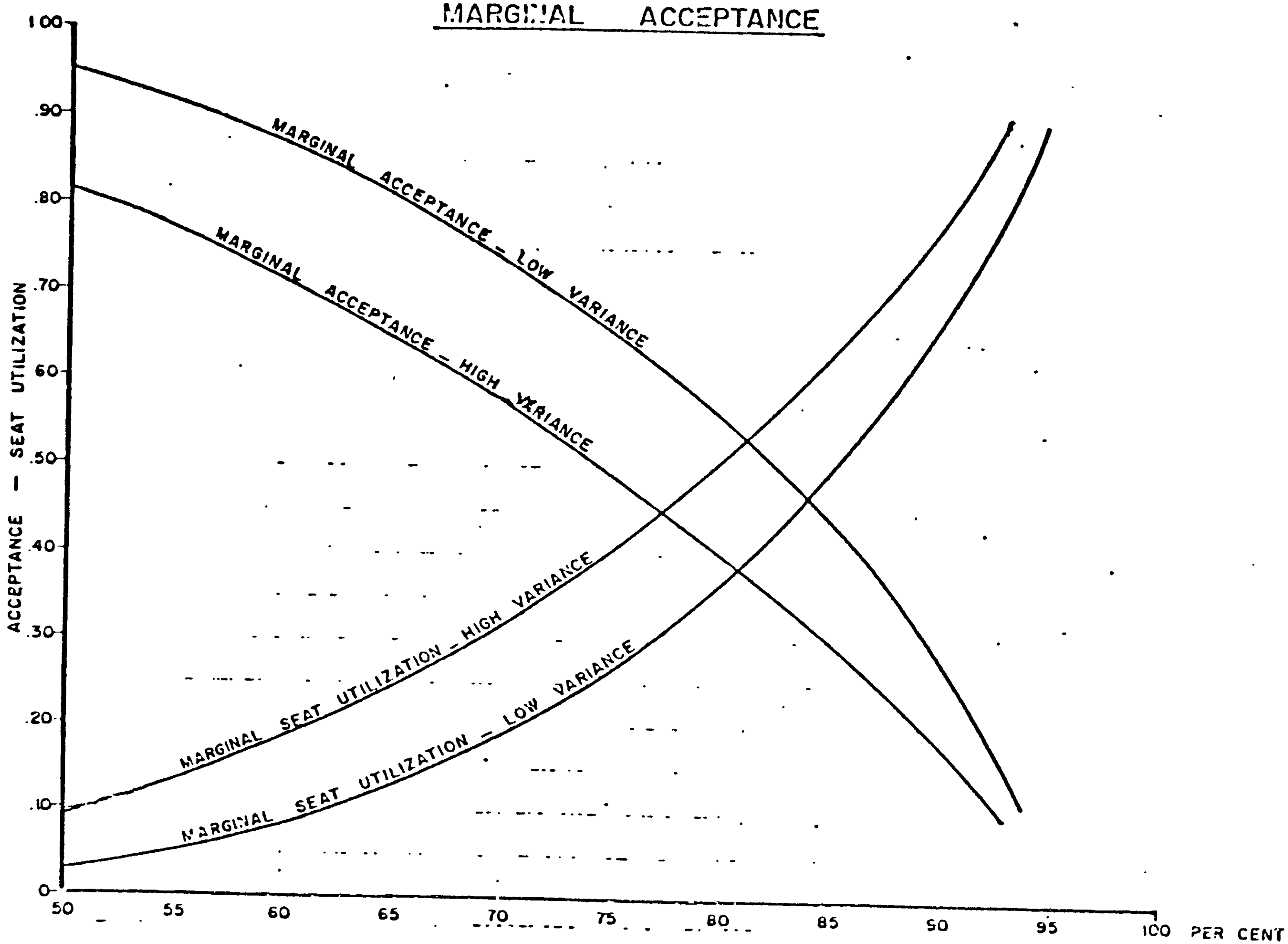

ILLUSTRATION II

The following example illustrates the type of situation which has been considered under Case B on page 18. A choice between two aircraft, a 180 seater and a 150 seater.

Here again two markets were assumed: a high variance and a low variance. (As specified under Illustration I).

For level of demand, the following market conditions were assumed:

D + 20% = D x (1.2) = 810 passengers
D + 40% = D x (1.4) = 945 "
D + 60% = D x (1.6) = 1080 "
D + 80% = D x (1.8) = 1215 "

Comparisons were then made between:

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A- Average loads assuming equal frequency. (5 flights of 150 seater Vs 5 flights of 180 seater)

B- Total loads assuming equal capacity. (900 seats by 6 flights of 150 seater Vs 5 flights of 180 seater)

The Inputs and Outputs are summarized herebelow:

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ILLUSTRATION II - SUMMARY OF RESULTS

Equal Frequency - Low Variance

Application No.	Demand	Average Load (Passengers) 150 Seater	Average Load (Passengers) 180 Seater	Gain Per Flight
1	810	80.14	80.96	.82
2	945	91.98	93.83	1.85
3	1080	102.54	105.99	3.45
4	1215	111.60	117.19	5.58

Equal Frequency - High Variance

Application No.	Demand	Average Load (Passengers) 150 Seater	Average Load (Passengers) 180 Seater	Gain Per Flight
5	810	86.79	90.54	3.76
6	945	96.69	102.38	5.69
7	1080	105.01	112.84	7.83
8	1215	111.89	121.94	10.05

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Equal Capacity - Low Variance

		Total Load (Passengers)		
Application No.	Demand	5 x 180	6 x 150	Overall Gain
9	810	385.89	404.15	18.25
10	945	447.78	468.39	20.60
11	1080	506.66	528.98	22.32
12	1215	561.33	584.62	23.29

Equal Capacity - High Variance

		Total Load (Passengers)		
Application No.	Demand	5 x 180	6 x 150	Overall Gain
13	810	433.05	451.32	18.30
14	945	490.35	509.82	19.48
15	1080	541.38	561.42	20.04
16	1215	586.15	606.24	20.11

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APPLICATIONS

In the following pages some actual or hypothetical applications are presented with comments about:

The objective of each application

The Inputs

The Outputs

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Application A.1 | Comments

Conditions during Base Period

	Average Seating on Aircraft	Average Weekly Frequency	Average Passenger Load Factor
Airline X	123.0	5	57.5%
Other Airlines	168.5	8	68.4%
All Airlines	151.0	13	65 %

Assumptions for Alternatives One and Two

It is estimated that total demand in the market will grow by 16 percent. Airline X wishes to compare two possible operating plans:

Alternative One: Increase frequency to six per week with the same aircraft.

Alternative Two: Maintain the same frequency but operate with a larger aircraft of 158 seats.

It is expected that other airlines on the market will continue to operate the same types but will increase frequency by one per week, i.e., from 8 to 9.

It is estimated that, under Alternative One, Airline X will improve its market position as reflected by the 22% change in demand compared to 16% for the total market. Under Alternative Two, because of the reduced frequency, its share will slightly drop as portrayed by the new ratios of 15% for X against 16% for the total market.

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ASNA FORMULA

Application A.1 — INPUTS - OUTPUTS

Base Period P

Data Relating to Airline X on Sector S

Average Seating on Aircraft	Average Weekly Frequency
123	6

Frequency Distribution of Passenger Load Factors on Flights of Airline X during Period P

90.0 - 100%	.05	40.0 - 49.9%	.05
80.0 - 89.9%	.10	30.0 - 39.9%	.05
70.0 - 79.9%	.15	20.0 - 29.9%	.05
60.0 - 69.9%	.20	10.0 - 19.9%	.05
50.0 - 59.9%	.25	00.0 - 9.9%	.05

Data Relating to All Airlines on Sector S

Average Seating on Aircraft	Average Weekly Frequency	Passenger Load Factor
151	13	.65

Alternatives to be Assessed

	Alternative One	Alternative Two
Data Relating to Airline X		
Average Seating on Aircraft	123	158
Average Weekly Frequency	6	5
Data Relating to All Airlines on the Sector		
Average Seating on Aircraft	150	165
Average Weekly Frequency	15	14

Rates of Change in Demand

For Airline X under Alternative One	For Airline X under Alternative Two	For Total Market regardless of Alternative
.22	.15	.16

OUTPUT

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	70.73	.58	.28
Alternative One	72.30	.59	.29
Alternative Two	81.36	.51	.27
Change per Flight	9.05		
Change All Flights	-27.03		

Application A.2 | Comments

The inputs remain the same as for Application A.1. Also the assumptions regarding frequency and size of aircraft under Alternatives One and Two.

The only difference is in the rate of change of demand for Airline X under Alternative Two. This has been increased from 15% to 16% in order to measure the sensitivity of variations in the assumed value of this variable.

The Outputs show that this increase of 1% has resulted in changing the average passengers on Airline X under Alternative Two, from: 81.36 to 81.88 i.e. 0.52 passengers which is equivalent to 0.6%.

ASNA FORMULA

Application A.2

INPUTS - OUTPUTS

Base Period P

Data Relating to Airline X on Sector S

Average Seating on Aircraft	Average Weekly Frequency
123	5

Frequency Distribution of Passenger Load Factors on Flights of Airline X during Period P

90.0 - 100%	.05	40.0 - 49.9%	.05
80.0 - 89.9%	.10	30.0 - 39.9%	.05
70.0 - 79.9%	.15	20.0 - 29.9%	.05
60.0 - 69.9%	.20	10.0 - 19.9%	.05
50.0 - 59.9%	.25	00.0 - 9.9%	.05

Data Relating to All Airlines on Sector S

Average Seating on Aircraft	Average Weekly Frequency	Passenger Load Factor
151	13	.65

Alternatives to be Assessed

	Alternative One	Alternative Two
Data Relating to Airline X		
Average Seating on Aircraft	123	158
Average Weekly Frequency	6	5
Data Relating to All Airlines on the Sector		
Average Seating on Aircraft	150	165
Average Weekly Frequency	15	14

Rates of Change in Demand

For Airline X under Alternative One	For Airline X under Alternative Two	For Total Market regardless of Alternative
.22	.16	.16

OUTPUT

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	70.73	.58	.28
Alternative One	72.30	.59	.29
Alternative Two	81.88	.52	.28
Change per Flight	9.58		
Change All Flights	-24.41		

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Application A.3 | Comments

This Application repeats the test carried out in Application A.2, with the same assumptions but with another increase of 1% in the demand for Airline X under Alternative Two.

The resulting increase in average passengers on Airline X is: from 81.88 to 82.40, i.e. 0.52 passengers which is consistent with the result previously arrived at under Application A.2.

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ASNA FORMULA

Application *A.3* — INPUTS - OUTPUTS

Base Period P

Data Relating to Airline X on Sector S

Average Seating on Aircraft	Average Weekly Frequency
123	5

Frequency Distribution of Passenger Load Factors on Flights of Airline X during Period P

90.0 - 100%	.05	40.0 - 49.9%	.05
80.0 - 89.9%	.10	30.0 - 39.9%	.05
70.0 - 79.9%	.15	20.0 - 29.9%	.05
60.0 - 69.9%	.20	10.0 - 19.9%	.05
50.0 - 59.9%	.25	00.0 - 9.9%	.05

Data Relating to All Airlines on Sector S

Average Seating on Aircraft	Average Weekly Frequency	Passenger Load Factor
151	13	.65

Alternatives to be Assessed

	Alternative One	Alternative Two
Data Relating to Airline X		
Average Seating on Aircraft	123	158
Average Weekly Frequency	6	5
Data Relating to All Airlines on the Sector		
Average Seating on Aircraft	150	165
Average Weekly Frequency	15	14

Rates of Change in Demand

For Airline X under Alternative One	For Airline X under Alternative Two	For Total Market regardless of Alternative
.22	.17	.16

OUTPUT

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	70.73	.58	.28
Alternative One	72.30	.59	.29
Alternative Two	82.40	.52	.28
Change per Flight	10.10		
Change All Flights	-21.80		

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Application A.4 | Comments

Here again the inputs are the same as in Applications A.1, A.2 and A.3 except for a further increase of 1% in the demand for Airline X under Alternative Two.

The result is again similar to what was obtained previously i.e., a resulting increase of 0.52 passengers per flight.

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ASNA FORMULA

Application A.4 — INPUTS - OUTPUTS

Base Period P

Data Relating to Airline X on Sector S

Average Seating on Aircraft	Average Weekly Frequency
123	6

Frequency Distribution of Passenger Load Factors on Flights of Airline X during Period P

90.0 - 100%	.05	40.0 - 49.9%	.05
80.0 - 89.9%	.10	30.0 - 39.9%	.05
70.0 - 79.9%	.15	20.0 - 29.9%	.05
60.0 - 69.9%	.20	10.0 - 19.9%	.05
50.0 - 59.9%	.25	00.0 - 9.9%	.05

Data Relating to All Airlines on Sector S

Average Seating on Aircraft	Average Weekly Frequency	Passenger Load Factor
151	13	.65

Alternatives to be Assessed

	Alternative One	Alternative Two
Data Relating to Airline X		
Average Seating on Aircraft	123	158
Average Weekly Frequency	6	5
Data Relating to All Airlines on the Sector		
Average Seating on Aircraft	150	165
Average Weekly Frequency	15	14

Rates of Change in Demand

For Airline X under Alternative One	For Airline X under Alternative Two	For Total Market regardless of Alternative
.22	.18	.16

OUTPUT

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	70.73	.58	.28
Alternative One	72.30	.59	.29
Alternative Two	82.92	.52	.28
Change per Flight	10.62		
Change All Flights	-19.18		

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Application A.5 | Comments

This is the fifth in the series of tests of the effects of a change in demand for Airline X under one of the two Alternatives.

In the given applications, the share of Airline X under Alternative Two has been incrementally increased from 15% to 19%. The resulting changes in average passengers per flight have been constant at 0.52 passengers per 1% change in demand.

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ASNA FORMULA

Application *A.5* INPUTS - OUTPUTS

Base Period P

Data Relating to Airline X on Sector S

Average Seating on Aircraft	Average Weekly Frequency
123	*5*

Frequency Distribution of Passenger Load Factors on Flights of Airline X during Period P

90.0 - 100%	*.05*	40.0 - 49.9%	*.05*
80.0 - 89.9%	*.10*	30.0 - 39.9%	*.05*
70.0 - 79.9%	*.15*	20.0 - 29.9%	*.05*
60.0 - 69.9%	*.20*	10.0 - 19.9%	*.05*
50.0 - 59.9%	*.25*	00.0 - 9.9%	*.05*

Data Relating to All Airlines on Sector S

Average Seating on Aircraft	Average Weekly Frequency	Passenger Load Factor
151	*13*	*.65*

Alternatives to be Assessed

	Alternative One	Alternative Two
Data Relating to Airline X		
Average Seating on Aircraft	*123*	*158*
Average Weekly Frequency	*6*	*5*
Data Relating to All Airlines on the Sector		
Average Seating on Aircraft	*150*	*165*
Average Weekly Frequency	*15*	*14*

Rates of Change in Demand

For Airline X under Alternative One	For Airline X under Alternative Two	For Total Market regardless of Alternative
.22	*.19*	*.16*

OUTPUT

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	*70.73*	*.58*	*.28*
Alternative One	*72.30*	*.59*	*.29*
Alternative Two	*83.44*	*.53*	*.28*
Change per Flight	*11.14*		
Change All Flights	*-16.62*		

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Application A.6 | Comments

This application is for the measurement of the effect of a change in the seating configuration of an aircraft on its passenger loads.

Specifically, the question arose when Airline X faced a choice between 9 abreast and 10 abreast seating on its fleet of 747 aircraft. With 9 abreast seating, there is a loss of 38 seats from 378 to 340. Against this loss, there is the improved comfort to the passengers. It was therefore important to know the passenger loss corresponding to this loss of seats.

All other conditions have been assumed constant.

The results show a loss of 3.26 passengers or approximately 2%.

It is important to note that this result is only valid for the conditions that were assumed. In particular it can be seen that the load factor for the two alternatives lies between 46% and 50%, Obviously, for a higher load factor, the loss would have been greater.

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APPLICATION A.6 INPUTS AND OUTPUTS

141	8	
6.00000000E-02	.1	
9.00000000E-02	5.00000000E-02	
.2	0	
.3	0	
.2	0	
158	28	.55
340	378	
7	7	
216	223	
34	34	
.737	.737	.737
91.791	.651	.2536363636364
169.6454228314	.4989571259748	.23613578018
172.9058321711	.4574228364316	.2406740653297
3.2604093397		
22.822865378		

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Application A.7 | Comments

This application is one of a series of three aimed at measuring the effects of changes in capacity and frequency on average loads.

The following table shows the various combinations of capacity and frequency:

	Airline X		Other Airlines	
	Seating	Frequency	Seating	Frequency
Base Period	120	5	140	8
Alternative One	150	6	160	8
Alternative Two	180	5	160	8

The results show a gain per flight on 12.22 passengers but an overall loss, because of the reduced frequency, of 17.90 passengers.

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APPLICATION A.7 INPUTS AND OUTPUTS

1	0	
120	5	
.1	.1	
.1	.1	
.1	.1	
.1	.1	
.1	.1	
132.3077	13	.5651
150	180	
6	5	
155.7143	167.6923	
14	13	
.5	.5	.5
60	.5	.308650848541
78.97821124962	.5265214083308	.3250225589126
91.1943850882	.5066354727122	.3127469371072
12.21617383858		
-17.8973420567		

Application A.8 Comments

In this application, the same conditions as in Application A.8 have been maintained except that the change in demand for Airline X under Alternative One was increased from .5 to .55 to reflect a stronger market position due to the higher frequency.

The effect of this change is that the average passengers per flight with the 150 seater aircraft increases from 78.98 to 80.60 passengers, i.e., 1.62 passengers or approximately 2% which should be compared to the demand increasing from 1.5 to 1.55 which is 3%.

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APPLICATION A.8 INPUTS AND OUTPUTS

2	0	
120	5	
.1	.1	
.1	.1	
.1	.1	
.1	.1	
.1	.1	
132.3077	13	.5651
150	180	
6	5	
155.7143	167.6923	
14	13	
.55	.5	.5
60	.5	.308650848541
80.60318156792	.5373545437861	.33170987181139
91.1943850882	.5066354727122	.3127469371072
10.59120352028		
-27.6471639665		

Application A.9 Comments

In this application, which is the third of the series, all conditions were again maintained as in the previous two, A.7 and A.8, except that instead of increasing the demand for Airline X under Alternative One, a reduction of .05 was introduced under Alternative Two.

The effect of this change was to reduce the difference between the two alternatives to 10.23 passengers as against 10.59 in the previous application.

It is interesting to note that the overall loss in Alternative Two as compared to Alternative One is almost identical under Applications A.8 and A.9. Uuder A.8 it amounted to 27.65 while under A.9 it was 27.80.

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APPLICATION A.9 INPUTS AND OUTPUTS

3	0	
120	5	
.1	.1	
.1	.1	
.1	.1	
.1	.1	
.1	.1	
132.3077	13	.5651
150	180	
6	5	
155.7143	167.6923	
14	13	
.5	.45	.5
60	.5	.308650848541
78.97821124962	.5265214083308	.3250225589126
89.21294914782	.4956274952657	.305951693948
10.2347378982		
-27.8045217586		

A P P E N D I X I

I L L U S T R A T I O N I

DETAILS OF OUTPUTS AND RESULTS

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Appendix I-1

Marginal Seat Utilization*

High Variance

Average Passengers (150 Seats)	Average Passengers (151 Seats)	MSU	L.F.%
81.049	81.177	.128	54.0
81.681	81.813	.131	54.5
86.610	86.772	.162	57.7
87.249	87.415	.166	58.2
91.758	91.956	.198	61.2
92.397	92.600	.203	61.6
96.500	96.737	.237	64.3
97.131	97.374	.242	64.8
100.843	101.120	.276	67.2
101.466	101.748	.282	67.6
104.809	105.125	.316	69.9
105.412	105.735	.323	70.3
108.422	108.779	.356	72.3
108.998	109.361	.363	72.7
111.693	112.089	.396	74.5
112.249	112.653	.404	74.8
114.656	115.090	.434	76.4
115.189	115.630	.441	76.8
117.342	117.813	.471	78.2
117.848	118.326	.478	78.6
127.410	128.039	.629	84.9
127.793	128.429	.636	85.2
133.513	134.262	.749	89.0
133.782	134.537	.755	89.2
137.160	137.997	.837	91.4
137.357	138.199	.842	91.6
139.284	140.187	.903	92.9
139.423	140.328	.905	92.9
140.921	141.903	.983	93.9
140.945	141.931	.986	94.0

* Per 1 Additional Seat

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Appendix I-2

Marginal Acceptance*

High Variance

Average Passengers	Change	M.A.	L.F.%
81.049			54.0
	+.632	+.780	
81.681			54.5
86.610			57.7
	+.639	+.738	
87.249			58.2
91.758			61.2
	+.639	+.696	
92.397			61.6
96.500			64.3
	+.631	+.654	
97.131			64.8
100.843			67.2
	+.623	+.618	
101.466			67.6
104.809			69.9
	+.603	+.575	
105.412			70.3
108.422			72.3
	+.576	+.531	
108.998			72.7
111.693			74.5
	+.556	+.498	
112.249			74.8
114.656			76.4
	+.533	+.465	
115.189			76.8
117.342			78.2
	+.506	+.431	
117.848			78.6
127.410			84.9
	+.383	+.301	
127.793			85.2
133.513			89.0
	+.269	+.201	
133.782			89.2
137.160			91.4
	+.197	+.144	
137.357			91.6
139.284			92.9
	+.139	+.100	
139.423			92.9
140.921			93.9
	+.024	+.017	
140.945			94.0

* Per 1% Increase in Demand

Appendix I-3

Marginal Seat Utilization*

Low Variance

Average Passengers (150 Seats)	Average Passengers (151 Seats)	MSU	L.F.%
74.003	74.032	.029	49.3
74.707	74.738	.031	49.8
80.311	80.357	.046	53.5
81.053	81.101	.048	54.0
86.381	86.449	.068	57.6
87.152	87.223	.071	58.1
92.167	92.264	.096	61.4
92.953	93.053	.100	62.0
97.628	97.758	.130	65.1
98.420	98.556	.136	65.6
102.736	102.906	.171	68.5
103.520	103.695	.175	69.0
107.467	107.679	.212	71.6
108.235	108.455	.220	72.2
111.811	112.070	.259	74.5
112.552	112.822	.269	75.0
115.763	116.071	.308	77.2
116.477	116.794	.317	77.7
119.336	119.694	.358	79.6
120.011	120.378	.368	80.0
132.089	132.686	.597	88.1
132.550	133.157	.607	88.4
138.582	139.354	.772	92.4
138.823	139.603	.780	92.5
141.547	142.427	.880	94.4
141.655	142.541	.886	94.4
142.669	143.614	.945	95.1
142.697	143.644	.947	95.1

* Per 1 Additional Seat

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Appendix I-4

Marginal Acceptance*

Low Variance

Average Passengers	Change	M.A.	L.F.%
74.003			49.3
	+.704	+.951	
74.707			49.8
80.311			53.5
	+.742	+.924	
81.053			54.0
86.381			57.6
	+.771	+.893	
87.152			58.1
92.167			61.4
	+.786	+.853	
92.953			62.0
97.628			65.1
	+.792	+.811	
98.420			65.6
102.736			68.5
	+.784	+.763	
103.520			69.0
107.467			71.6
	+.768	+.715	
108.235			72.2
111.811			74.5
	+.741	+.663	
112.552			75.0
115.763			77.2
	+.714	+.617	
116.477			77.7
119.336			79.6
	+.675	+.566	
120.011			80.0
132.089			88.1
	+.461	+.349	
132.550			88.4
138.582			92.4
	+.241	+.174	
138.823			92.5
141.547			94.4
	+.108	+.076	
141.655			94.4
142.669			95.1
	+.028	+.020	
142.697			95.1

* Per 1% Increase in Demand

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A P P E N D I X II

I L L U S T R A T I O N II

DETAILS OF OUTPUTS AND RESULTS

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INPUT FORM - ASNA FORMULA - II 1

(Sector S)

0. Base Period P

0.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5
Frequency Distribution of Passenger Load Factor on Flights of Airline X during Period P		
90.0 - 100%	:	0
80.0 - 89.9%	:	0
70.0 - 79.9%	:	0
60.0 - 69.9%	:	0
50.0 - 59.9%	:	0
40.0 - 49.9%	:	1
30.0 - 39.9%	:	0
20.0 - 29.9%	:	0
10.0 - 19.9%	:	0
00.0 - 9.9%	:	0

0.2. Data Relating to All Airlines on Sector S

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10
Combined Passenger Load Factor	:	.45

1. Alternative One

1.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5

1.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10

2. Alternative Two

2.1. Data Relating to Airline X

Average Seating on Aircraft	:	180
Average Weekly Frequency	:	5

2.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	165
Average Weekly Frequency	:	10

3. Growth Rates

3.1. For Airline X under Alternative One	:	.2
3.2. For Airline X under Alternative Two	:	.2
3.3. For Total Market regardless of Alternative	:	.2

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ASNA FORMULA - OUPUT - II 1

(Sector S)

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	67.50	.45	.50
Alternative One	80.14	.53	.49
Alternative Two	80.96	.45	.50
Change Per Flight	.82		
Change All Flights	4.08		

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INPUT FORM - ASNA FORMULA - II 2

(Sector S)

0. Base Period P

0.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5
Frequency Distribution of Passenger Load Factor on Flights of Airline X during Period P		
90.0 - 100%	:	0
80.0 - 89.9%	:	0
70.0 - 79.9%	:	0
60.0 - 69.9%	:	0
50.0 - 59.9%	:	0
40.0 - 49.9%	:	1
30.0 - 39.9%	:	0
20.0 - 29.9%	:	0
10.0 - 19.9%	:	0
00.0 - 9.9%	:	0

0.2. Data Relating to All Airlines on Sector S

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10
Combined Passenger Load Factor	:	.45

1. Alternative One

1.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5

1.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10

2. Alternative Two

2.1. Data Relating to Airline X

Average Seating on Aircraft	:	180
Average Weekly Frequency	:	5

2.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	165
Average Weekly Frequency	:	10

3. Growth Rates

3.1. For Airline X under Alternative One	:	.4
3.2. For Airline X under Alternative Two	:	.4
3.3. For Total Market regardless of Alternative	:	.4

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ASNA FORMULA - OUPUT - II 2

(Sector S)

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	67.50	.45	.50
Alternative One	91.98	.61	.49
Alternative Two	93.83	.52	.50
Change Per Flight	1.85		
Change All Flights	9.24		

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INPUT FORM - ASNA FORMULA - II 3

(Sector S)

0. Base Period P

0.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5
Frequency Distribution of Passenger Load Factor on Flights of Airline X during Period P		
90.0 - 100%	:	0
80.0 - 89.9%	:	0
70.0 - 79.9%	:	0
60.0 - 69.9%	:	0
50.0 - 59.9%	:	0
40.0 - 49.9%	:	1
30.0 - 39.9%	:	0
20.0 - 29.9%	:	0
10.0 - 19.9%	:	0
00.0 - 9.9%	:	0

0.2. Data Relating to All Airlines on Sector S

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10
Combined Passenger Load Factor	:	.45

1. Alternative One

1.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5

1.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10

2. Alternative Two

2.1. Data Relating to Airline X

Average Seating on Aircraft	:	180
Average Weekly Frequency	:	5

2.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	165
Average Weekly Frequency	:	10

3. Growth Rates

3.1. For Airline X under Alternative One	:	.6
3.2. For Airline X under Alternative Two	:	.6
3.3. For Total Market regardless of Alternative	:	.6

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ASNA FORMULA - OUPUT - II 3

(Sector S)

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	67.50	.45	.50
Alternative One	102.54	.68	.47
Alternative Two	105.99	.59	.49
Change Per Flight	3.45		
Change All Flights	17.27		

.../111

INPUT FORM - ASNA FORMULA - II 4

(Sector S)

0. Base Period P

0.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5
Frequency Distribution of Passenger Load Factor on Flights of Airline X during Period P		
90.0 - 100%	:	0
80.0 - 89.9%	:	0
70.0 - 79.9%	:	0
60.0 - 69.9%	:	0
50.0 - 59.9%	:	0
40.0 - 49.9%	:	1
30.0 - 39.9%	:	0
20.0 - 29.9%	:	0
10.0 - 19.9%	:	0
00.0 - 9.9%	:	0

0.2. Data Relating to All Airlines on Sector S

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10
Combined Passenger Load Factor	:	.45

1. Alternative One

1.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5

1.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10

2. Alternative Two

2.1. Data Relating to Airline X

Average Seating on Aircraft	:	180
Average Weekly Frequency	:	5

2.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	165
Average Weekly Frequency	:	10

3. Growth Rates

3.1.	For Airline X under Alternative One	:	.8
3.2.	For Airline X under Alternative Two	:	.8
3.3.	For Total Market regardless of Alternative	:	.8

.../112

ASNA FORMULA - OUPUT - II 4

(Sector S)

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	67.50	.45	.50
Alternative One	111.60	.74	.46
Alternative Two	117.19	.65	.48
Change Per Flight	5.58		
Change All Flights	27.91		

.../113

INPUT FORM - ASNA FORMULA - II 5

(Sector S)

0. Base Period P

0.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5
Frequency Distribution of Passenger Load Factor on Flights of Airline X during Period P		
90.0 - 100%	:	.02
80.0 - 89.9%	:	.06
70.0 - 79.9%	:	.10
60.0 - 69.9%	:	.14
50.0 - 59.9%	:	.18
40.0 - 49.9%	:	.18
30.0 - 39.9%	:	.14
20.0 - 29.9%	:	.10
10.0 - 19.9%	:	.06
00.0 - 9.9%	:	.02

0.2. Data Relating to All Airlines on Sector S

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10
Combined Passenger Load Factor	:	.45

1. Alternative One

1.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5

1.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10

2. Alternative Two

2.1. Data Relating to Airline X

Average Seating on Aircraft	:	180
Average Weekly Frequency	:	5

2.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	165
Average Weekly Frequency	:	10

3. Growth Rates

3.1. For Airline X under Alternative One	:	.2
3.2. For Airline X under Alternative Two	:	.2
3.3. For Total Market regardless of Alternative	:	.2

.../114

ASNA FORMULA - OUPUT - II 5

(Sector S)

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	75	.50	.56
Alternative One	86.79	.58	.54
Alternative Two	90.54	.50	.56
Change Per Flight	3.76		
Change All Flights	18.80		

.../115

INPUT FORM - ASNA FORMULA - II 6

(Sector S)

0. Base Period P

0.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5

Frequency Distribution of Passenger Load Factor on Flights of Airline X during Period P

90.0 - 100%	:	.02
80.0 - 89.9%	:	.06
70.0 - 79.9%	:	.10
60.0 - 69.9%	:	.14
50.0 - 59.9%	:	.18
40.0 - 49.9%	:	.18
30.0 - 39.9%	:	.14
20.0 - 29.9%	:	.10
10.0 - 19.9%	:	.06
00.0 - 9.9%	:	.02

0.2. Data Relating to All Airlines on Sector S

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10
Combined Passenger Load Factor	:	.45

1. Alternative One

1.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5

1.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10

2. Alternative Two

2.1. Data Relating to Airline X

Average Seating on Aircraft	:	180
Average Weekly Frequency	:	5

2.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	165
Average Weekly Frequency	:	10

3. Growth Rates

3.1. For Airline X under Alternative One	:	.4
3.2. For Airline X under Alternative Two	:	.4
3.3. For Total Market regardless of Alternative	:	.4

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ASNA FORMULA - OUPUT - II 6

(Sector S)

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	75	.50	.56
Alternative One	96.69	.64	.51
Alternative Two	102.38	.57	.54
Change Per Flight	5.69		
Change All Flights	28.44		

.../117

INPUT FORM - ASNA FORMULA - II 7

(Sector S)

0. Base Period P

0.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5
Frequency Distribution of Passenger Load Factor on Flights of Airline X during Period P		
90.0 - 100%	:	.02
80.0 - 89.9%	:	.06
70.0 - 79.9%	:	.10
60.0 - 69.9%	:	.14
50.0 - 59.9%	:	.18
40.0 - 49.9%	:	.18
30.0 - 39.9%	:	.14
20.0 - 29.9%	:	.10
10.0 - 19.9%	:	.06
00.0 - 9.9%	:	.02

0.2. Data Relating to All Airlines on Sector S

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10
Combined Passenger Load Factor	:	.45

1. Alternative One

1.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5

1.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10

2. Alternative Two

2.1. Data Relating to Airline X

Average Seating on Aircraft	:	180
Average Weekly Frequency	:	5

2.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	165
Average Weekly Frequency	:	10

3. Growth Rates

3.1. For Airline X under Alternative One	:	.6
3.2. For Airline X under Alternative Two	:	.6
3.3. For Total Market regardless of Alternative	:	.6

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ASNA FORMULA - OUPUT - II 7

(Sector S)

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	75	.50	.56
Alternative One	105.01	.70	.49
Alternative Two	112.84	.63	.52
Change Per Flight	7.83		
Change All Flights	39.14		

.../119

INPUT FORM - ASNA FORMULA - II 8

(Sector S)

0. Base Period P

0.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5

Frequency Distribution of Passenger Load Factor on Flights of Airline X during Period P

90.0 - 100%	:	.02
80.0 - 89.9%	:	.06
70.0 - 79.9%	:	.10
60.0 - 69.9%	:	.14
50.0 - 59.9%	:	.18
40.0 - 49.9%	:	.18
30.0 - 39.9%	:	.14
20.0 - 29.9%	:	.10
10.0 - 19.9%	:	.06
00.0 - 9.9%	:	.02

0.2. Data Relating to All Airlines on Sector S

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10
Combined Passenger Load Factor	:	.45

1. Alternative One

1.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5

1.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10

2. Alternative Two

2.1. Data Relating to Airline X

Average Seating on Aircraft	:	180
Average Weekly Frequency	:	5

2.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	165
Average Weekly Frequency	:	10

3. Growth Rates

3.1. For Airline X under Alternative One	:	.8
3.2. For Airline X under Alternative Two	:	.8
3.3. For Total Market regardless of Alternative	:	.8

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ASNA FORMULA - OUPUT - II 8

(Sector S)

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	75	.50	.56
Alternative One	111.89	.75	.46
Alternative Two	121.94	.68	.50
Change Per Flight	10.05		
Change All Flights	50.25		

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INPUT FORM - ASNA FORMULA - II 9

(Sector S)

0. Base Period P

0.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5
Frequency Distribution of Passenger Load Factor on Flights of Airline X during Period P		
90.0 - 100%	:	0
80.0 - 89.9%	:	0
70.0 - 79.9%	:	0
60.0 - 69.9%	:	0
50.0 - 59.9%	:	0
40.0 - 49.9%	:	1
30.0 - 39.9%	:	0
20.0 - 29.9%	:	0
10.0 - 19.9%	:	0
00.0 - 9.9%	:	0

0.2. Data Relating to All Airlines on Sector S

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10
Combined Passenger Load Factor	:	.45

1. Alternative One

1.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	6

1.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	12

2. Alternative Two

2.1. Data Relating to Airline X

Average Seating on Aircraft	:	180
Average Weekly Frequency	:	5

2.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	163.6364
Average Weekly Frequency	:	11

3. Growth Rates

3.1. For Airline X under Alternative One	:	.2
3.2. For Airline X under Alternative Two	:	.2
3.3. For Total Market regardless of Alternative	:	.2

ASNA FORMULA - OUPUT - II 9

(Sector S)

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	67.50	.45	.50
Alternative One	67.36	.45	.50
Alternative Two	77.18	.43	.48
Change Per Flight	9.82		
Change All Flights	- 18.25		

.../123

INPUT FORM - ASNA FORMULA - II 10

(Sector S)

0. Base Period P

0.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5
Frequency Distribution of Passenger Load Factor on Flights of Airline X during Period P		
90.0 - 100%	:	0
80.0 - 89.9%	:	0
70.0 - 79.9%	:	0
60.0 - 69.9%	:	0
50.0 - 59.9%	:	0
40.0 - 49.9%	:	1
30.0 - 39.9%	:	0
20.0 - 29.9%	:	0
10.0 - 19.9%	:	0
00.0 - 9.9%	:	0

0.2. Data Relating to All Airlines on Sector S

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10
Combined Passenger Load Factor	:	.45

1. Alternative One

1.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	6

1.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	12

2. Alternative Two

2.1. Data Relating to Airline X

Average Seating on Aircraft	:	180
Average Weekly Frequency	:	5

2.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	163.6364
Average Weekly Frequency	:	11

3. Growth Rates

3.1. For Airline X under Alternative One	:	.4
3.2. For Airline X under Alternative Two	:	.4
3.3. For Total Market regardless of Alternative	:	.4

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ASNA FORMULA - OUPUT - II 10

(Sector S)

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	67.50	.45	.50
Alternative One	78.06	.52	.50
Alternative Two	89.56	.50	.47
Change Per Flight	11.49		
Change All Flights	-20.60		

.../125

INPUT FORM - ASNA FORMULA - II 11

(Sector S)

0. Base Period P

0.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5
Frequency Distribution of Passenger Load Factor on Flights of Airline X during Period P		
90.0 - 100%	:	0
80.0 - 89.9%	:	0
70.0 - 79.9%	:	0
60.0 - 69.9%	:	0
50.0 - 59.9%	:	0
40.0 - 49.9%	:	1
30.0 - 39.9%	:	0
20.0 - 29.9%	:	0
10.0 - 19.9%	:	0
00.0 - 9.9%	:	0

0.2. Data Relating to All Airlines on Sector S

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10
Combined Passenger Load Factor	:	.45

1. Alternative One

1.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	6

1.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	12

2. Alternative Two

2.1. Data Relating to Airline X

Average Seating on Aircraft	:	180
Average Weekly Frequency	:	5

2.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	163.6364
Average Weekly Frequency	:	11

3. Growth Rates

3.1. For Airline X under Alternative One	:	.6
3.2. For Airline X under Alternative Two	:	.6
3.3. For Total Market regardless of Alternative	:	.6

.../126

ASNA FORMULA - OUPUT - II 11

(Sector S)

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	67.50	.45	.50
Alternative One	88.16	.59	.49
Alternative Two	101.33	.56	.47
Change Per Flight	13.17		
Change All Flights	- 22.32		

.../127

INPUT FORM - ASNA FORMULA - II 12

(Sector S)

0. Base Period P

0.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5
Frequency Distribution of Passenger Load Factor on Flights of Airline X during Period P		
90.0 - 100%	:	0
80.0 - 89.9%	:	0
70.0 - 79.9%	:	0
60.0 - 69.9%	:	0
50.0 - 59.9%	:	0
40.0 - 49.9%	:	1
30.0 - 39.9%	:	0
20.0 - 29.9%	:	0
10.0 - 19.9%	:	0
00.0 - 9.9%	:	0

0.2. Data Relating to All Airlines on Sector S

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10
Combined Passenger Load Factor	:	.45

1. Alternative One

1.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	6

1.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	12

2. Alternative Two

2.1. Data Relating to Airline X

Average Seating on Aircraft	:	180
Average Weekly Frequency	:	5

2.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	163.6364
Average Weekly Frequency	:	11

3. Growth Rates

3.1. For Airline X under Alternative One	:	.8
3.2. For Airline X under Alternative Two	:	.8
3.3. For Total Market regardless of Alternative	:	.8

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ASNA FORMULA - OUPUT - II 12

(Sector S)

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	67.50	.45	.50
Alternative One	97.44	.65	.48
Alternative Two	112.27	.62	.46
Change Per Flight	14.83		
Change All Flights	- 23.29		

.../129

INPUT FORM - ASNA FORMULA - II 13

(Sector S)

0. Base Period P

0.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5
Frequency Distribution of Passenger Load Factor on Flights of Airline X during Period P		
90.0 - 100%	:	.02
80.0 - 89.9%	:	.06
70.0 - 79.9%	:	.10
60.0 - 69.9%	:	.14
50.0 - 59.9%	:	.18
40.0 - 49.9%	:	.18
30.0 - 39.9%	:	.14
20.0 - 29.9%	:	.10
10.0 - 19.9%	:	.06
00.0 - 9.9%	:	.02

0.2. Data Relating to All Airlines on Sector S

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10
Combined Passenger Load Factor	:	.45

1. Alternative One

1.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	6

1.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	12

2. Alternative Two

2.1. Data Relating to Airline X

Average Seating on Aircraft	:	180
Average Weekly Frequency	:	5

2.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	163.6364
Average Weekly Frequency	:	11

3. Growth Rates

3.1. For Airline X under Alternative One	:	.2
3.2. For Airline X under Alternative Two	:	.2
3.3. For Total Market regardless of Alternative	:	.2

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ASNA FORMULA - OUPUT - II 13

(Sector S)

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	75	.50	.56
Alternative One	75.22	.50	.56
Alternative Two	86.61	.48	.53
Change Per Flight	11.38		
Change All Flights	- 18.30		

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INPUT FORM - ASNA FORMULA - II 14

(Sector S)

0. Base Period P

0.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5
Frequency Distribution of Passenger Load Factor on Flights of Airline X during Period P		
90.0 - 100%	:	.02
80.0 - 89.9%	:	.06
70.0 - 79.9%	:	.10
60.0 - 69.9%	:	.14
50.0 - 59.9%	:	.18
40.0 - 49.9%	:	.18
30.0 - 39.9%	:	.14
20.0 - 29.9%	:	.10
10.0 - 19.9%	:	.06
00.0 - 9.9%	:	.02

0.2. Data Relating to All Airlines on Sector S

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10
Combined Passenger Load Factor	:	.45

1. Alternative One

1.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	6

1.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	12

2. Alternative Two

2.1. Data Relating to Airline X

Average Seating on Aircraft	:	180
Average Weekly Frequency	:	5

2.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	163.6364
Average Weekly Frequency	:	11

3. Growth Rates

3.1. For Airline X under Alternative One	:	.4
3.2. For Airline X under Alternative Two	:	.4
3.3. For Total Market regardless of Alternative	:	.4

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ASNA FORMULA - OUPUT - II 14

(Sector S)

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	75	.50	.56
Alternative One	84.97	.57	.54
Alternative Two	98.07	.54	.52
Change Per Flight	13.10		
Change All Flights	- 19.48		

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INPUT FORM - ASNA FORMULA - II 15

(Sector S)

0. Base Period P

0.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5
Frequency Distribution of Passenger Load Factor on Flights of Airline X during Period P		
90.0 - 100%	:	.02
80.0 - 89.9%	:	.06
70.0 - 79.9%	:	.10
60.0 - 69.9%	:	.14
50.0 - 59.9%	:	.18
40.0 - 49.9%	:	.18
30.0 - 39.9%	:	.14
20.0 - 29.9%	:	.10
10.0 - 19.9%	:	.06
00.0 - 9.9%	:	.02

0.2. Data Relating to All Airlines on Sector S

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10
Combined Passenger Load Factor	:	.45

1. Alternative One

1.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	6

1.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	12

2. Alternative Two

2.1. Data Relating to Airline X

Average Seating on Aircraft	:	180
Average Weekly Frequency	:	5

2.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	163.6364
Average Weekly Frequency	:	11

3. Growth Rates

3.1. For Airline X under Alternative One	:	.6
3.2. For Airline X under Alternative Two	:	.6
3.3. For Total Market regardless of Alternative	:	.6

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ASNA FORMULA - OUPUT - II 15

(Sector S)

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	75	.50	.56
Alternative One	93.57	.62	.52
Alternative Two	108.28	.60	.50
Change Per Flight	14.71		
Change All Flights	- 20.04		

.../135

INPUT FORM - ASNA FORMULA - II 16

(Sector S)

0. Base Period P

0.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	5
Frequency Distribution of Passenger Load Factor on Flights of Airline X during Period P		
90.0 - 100%	:	.02
80.0 - 89.9%	:	.06
70.0 - 79.9%	:	.10
60.0 - 69.9%	:	.14
50.0 - 59.9%	:	.18
40.0 - 49.9%	:	.18
30.0 - 39.9%	:	.14
20.0 - 29.9%	:	.10
10.0 - 19.9%	:	.06
00.0 - 9.9%	:	.02

0.2. Data Relating to All Airlines on Sector S

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	10
Combined Passenger Load Factor	:	.45

1. Alternative One

1.1. Data Relating to Airline X

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	6

1.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	150
Average Weekly Frequency	:	12

2. Alternative Two

2.1. Data Relating to Airline X

Average Seating on Aircraft	:	180
Average Weekly Frequency	:	5

2.2. Data Relating to All Airlines on the Sector

Average Seating on Aircraft	:	163.6364
Average Weekly Frequency	:	11

3. Growth Rates

3.1. For Airline X under Alternative One	:	.8
3.2. For Airline X under Alternative Two	:	.8
3.3. For Total Market regardless of Alternative	:	.8

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ASNA FORMULA - OUPUT - II 16

(Sector S)

	Average Passengers Per Flight Airline X	Passenger Load Factor Airline X	Share of Total Market Airline X
Base Period	75	.50	.56
Alternative One	101.04	.67	.50
Alternative Two	117.23	.65	.48
Change Per Flight	16.19		
Change All Flights	- 20.11		